US010040551B2

(12) United States Patent
Erickson et al.

(10) Patent No.: US 10,040,551 B2
(45) Date of Patent: Aug. 7, 2018

(54) DRONE DELIVERY OF COFFEE BASED ON A COGNITIVE STATE OF AN INDIVIDUAL

(71) Applicant: International Business Machines Corporation, Armonk, NY (US)

(72) Inventors: Thomas David Erickson, Minneapolis, MN (US); Rogerio S. Feris, Hartford, CT (US); Clifford A. Pickover, Yorktown Heights, NY (US); Maja Vukovic, New York, NY (US)

(73) Assignee: International Business Machines Corporation, Armonk, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 101 days.

(21) Appl. No.: 14/978,620

(22) Filed: Dec. 22, 2015

(65) Prior Publication Data

US 2017/0174343 A1 Jun. 22, 2017

(51) Int. Cl.
E04H 3/04 (2006.01)
B64C 39/02 (2006.01)
(Continued)

(52) U.S. Cl.
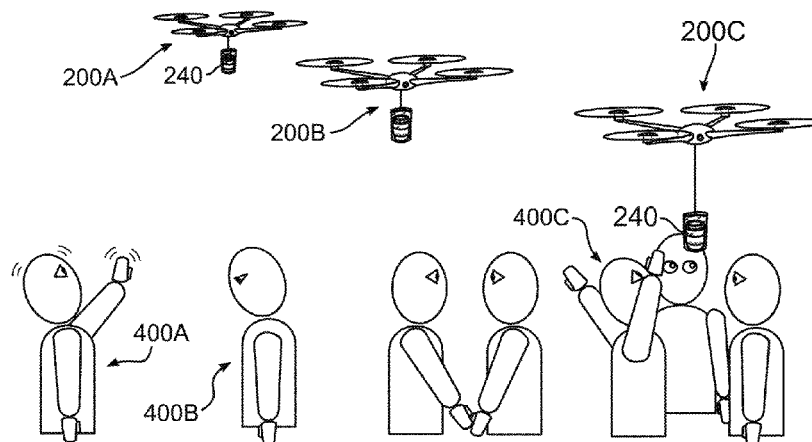CPC B64C 39/024 (2013.01); A61B 5/01 (2013.01); A61B 5/02055 (2013.01); A61B 5/11 (2013.01);
(Continued)

(58) Field of Classification Search
CPC A61B 5/1176; A61B 2034/2057; A61B 2034/2065; A61B 5/165; A61B 5/02055;
(Continued)

(56) References Cited

U.S. PATENT DOCUMENTS

5,094,153 A   3/1992 Helbling
6,419,629 B1   7/2002 Balkin et al.
(Continued)

FOREIGN PATENT DOCUMENTS

WO   0117362   3/2001
WO   2005000385   1/2005

OTHER PUBLICATIONS

Disclosed Anonymously, "Use of Flavors with Modifying Properties (FMP) in Flavor Compositions and Applications of FMP in Food and Beverage Products", IP.com No. 000240463, Jan. 30, 2015, pp. 1-43.
(Continued)

Primary Examiner — Jeffrey A Shapiro
(74) Attorney, Agent, or Firm — Fleit Gibbons Gutman Bongini Bianco PL; Gary Winer

(57) ABSTRACT

Coffee or other drink, for example a caffeine containing drink, is delivered to individuals that would like the drink, or who have a predetermined cognitive state, using an unmanned aerial vehicle (UAV)/drone. The drink is connected to the UAV, and the UAV flies to an area including people, and uses sensors to scan the people for an individual who has gestured that they would like the drink, or for whom an electronic analysis of sensor data indicates to be in a predetermined cognitive state. The UAV then flies to the individual to deliver the drink. The analysis can include profile data of people, including electronic calendar data, which can be used to determine a potentially predetermined cognitive state.

17 Claims, 4 Drawing Sheets

(51) **Int. Cl.**

A61B 5/16	(2006.01)
A61B 5/0205	(2006.01)
A61B 5/01	(2006.01)
A61B 5/1171	(2016.01)
A61B 5/11	(2006.01)
A61B 5/024	(2006.01)
A61B 5/021	(2006.01)
A61B 5/08	(2006.01)
A61B 3/11	(2006.01)

(52) **U.S. Cl.**
CPC *A61B 5/1176* (2013.01); *A61B 5/165* (2013.01); *A61B 3/112* (2013.01); *A61B 5/021* (2013.01); *A61B 5/024* (2013.01); *A61B 5/082* (2013.01); *B64C 2201/024* (2013.01); *B64C 2201/128* (2013.01); *B64C 2201/141* (2013.01)

(58) **Field of Classification Search**
CPC .. A61B 5/01; A61B 5/11; A61B 5/024; A61B 5/128; A61B 5/141; A61B 5/021; A61B 5/082; A61B 3/112; G06F 3/013; G06K 9/00221; G06K 9/00248; G06K 9/00302; G06K 9/00315; G06K 9/00308; G06K 7/00; G06K 7/10; G06T 2207/30201; H04N 5/23219; B64C 2201/00; B64C 2201/02; B64C 2201/022; B64C 2201/024; B64C 2201/027; B64C 2201/028; B64C 2201/04; B64C 2201/042; B64C 2201/044; B64C 2201/046; B64C 2201/048; B64C 2201/06; B64C 2201/063; B64C 2201/066; B64C 2201/08; B64C 2201/082; B64C 2201/084; B64C 2201/086; B64C 2201/088; B64C 2201/10; B64C 2201/101; B64C 2201/102; B64C 2201/104; B64C 2201/105; B64C 2201/107; B64C 2201/108; B64C 2201/12; B64C 2201/121; B64C 2201/122; B64C 2201/123; B64C 2201/125; B64C 2201/126; B64C 2201/127; B64C 2201/128; B64C 2201/14; B64C 2201/143; B64C 2201/145; B64C 2201/146; B64C 2201/148; B64C 2201/16; B64C 2201/162; B64C 2201/165; B64C 2201/167; B64C 2201/18; B64C 2201/182; B64C 2201/185; B64C 2201/187; B64C 2201/20; B64C 2201/201; B64C 2201/203; B64C 2201/205; B64C 2201/206; B64C 2201/208; B64C 2201/22; E04H 3/00; E04H 3/02; E04H 3/04; E04H 14/00; A47F 9/046; A47F 9/00; A47F 3/00; A47F 1/06; A47F 1/08; A47F 1/12; A47F 3/04; A47F 1/035; A47F 9/04; B07C 3/087; B65G 35/00
USPC 382/103, 104, 115, 118; 186/35, 36, 186/38–40, 51, 52, 55, 56, 7, 26
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,350,455 B2	4/2008	Vetterli	
7,384,394 B2	6/2008	Hursh et al.	
8,157,205 B2 *	4/2012	McWhirk	B64B 1/02 212/274
8,171,843 B1	5/2012	Heffington	
8,509,947 B2	8/2013	Jarisch et al.	
9,022,322 B2 *	5/2015	Westbrook, Sr.	B64C 39/024 244/137.1
9,044,543 B2	6/2015	Levien et al.	
9,321,531 B1 *	4/2016	Takayama	B64D 1/12
2005/0102246 A1 *	5/2005	Movellan	G06K 9/00248 706/12
2009/0152391 A1 *	6/2009	McWhirk	B64B 1/02 244/30
2010/0033333 A1 *	2/2010	Victor	A61B 3/113 340/576
2011/0313014 A1 *	12/2011	Robert	A23F 5/14 514/419
2012/0175468 A1	7/2012	Zerof	
2012/0298676 A1 *	11/2012	Cooks	B65D 1/04 220/592.21
2013/0103195 A1 *	4/2013	Anhalt	B25J 9/163 700/248
2013/0253733 A1 *	9/2013	Lee	B64C 19/00 701/2
2014/0067160 A1	3/2014	Levien et al.	
2014/0152792 A1 *	6/2014	Krueger	G01C 23/00 348/78
2014/0353422 A1 *	12/2014	Westbrook, Sr.	B64C 39/024 244/17.21
2014/0371912 A1	12/2014	Passot et al.	
2015/0046018 A1 *	2/2015	Hayashi	G05D 1/0088 701/26
2016/0068264 A1 *	3/2016	Ganesh	G08G 5/0069 701/2
2016/0189101 A1 *	6/2016	Kantor	G08G 5/0013 705/338
2016/0236778 A1 *	8/2016	Takayama	B64D 1/12

OTHER PUBLICATIONS

Disclosed Anonymously, "Storage Area Network Relocation Utilizing Drones", IP.com No. 000242096, Jun. 18, 2015, pp. 1-3.
Smarthome, "Beyond Coffee Maker", http://www.smarthome.com/beyond-coffee-maker.html, last visited on Nov. 17, 2015, p. 1.
AZ Central, "Coffee is a $30 Billion-a-Year U.S. Industry—and it's Growing", http://archive.azcentral.com/business/consumer/articles/20130410coffee-is-a-billionayear-us-industry-and-its-growing.html, last visited on Nov. 17, 2015, pp. 1-2.
Crane, E., "Is this the Office of the Future? Workplaces may Feature Coffee Delivered by Drones, Holographic Employees, and Robots", DailyMail.com, Feb. 5, 2015, http://www.dailymail.co.uk/news/article-2940535/Is-office-future-Innovative-report-says-coffee-delivered-drones-employees-holographic-25-years.html, pp. 1-5.
The Beverage Journal, "Drone Delivery Takes Wing for Milford's Tilted Kilt", Aug. 30, 2014, http://www.thebeveragejournal.com/tag/drone-delivery, pp. 1-2.
Business Insider, "Here's Why Venture-Capital Firms and Major Global Companies are Investing in Drone Startups", Nov. 6, 2015, http://www.businessinsider.com/drones-report-market-entrants-2015-3, pp. 1-3.
Lifehacker, "Five Best Sleep Tracking Gadgets or Apps", Mar. 31, 2013, http://lifehacker.com/5993005/five-best-sleep-tracking-gadgets-or-apps?tag=hive-five, pp. 1-9.
Hof, K., "If Lattes Could Fly: Dutch Engineers Invent Coffee Delivery Drone", Sprudge, Dec. 8, 2014, http://sprudge.com/coffee-drone-delivery-coffee-virus-amsterdam-a-lab-67046.html, pp. 1-14.
Eugenios, J., "What Would you Pay for a Drone Bartender?" CNN Money, Jun. 3, 2014, http://money.cnn.com/2014/06/03/luxury/drone-drinks, pp. 1-4.
Henry, A., "Sleep Time Alarm Clock for Android Watches Your Sleep Cycles, Wakes You Gently", Lifehacker, Sep. 12, 2012, Lifehacker, http://lifehacker.com/5942519/sleep-time-alarm-clock-for-android-watches-your-sleep-cycles-wakes-you-gently, pp. 1-2.
Contrera, J., "Apptitude: Up Coffee Helps Track Caffeine Intake", The Washington Post, Sep. 12, 2014, http://www.washingtonpost.

(56)   **References Cited**

OTHER PUBLICATIONS

com/lifestyle/magazine/apptitude-up-coffee-helps-track-caffeine-
intake/2014/09/10/1f3e79e4-0c52-11e4-8341-
b8072b1e7348_story.html, pp. 1-3.
Welsh, E.J., et al., "The Effect of Caffeine in People with Asthma",
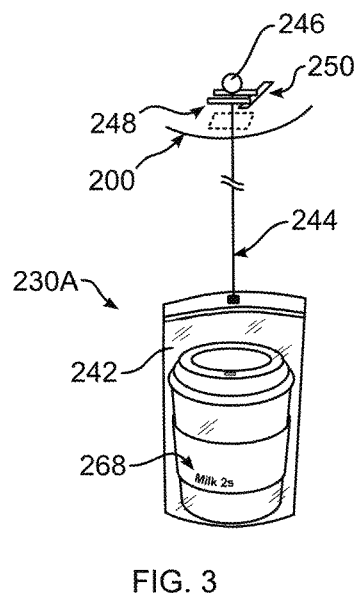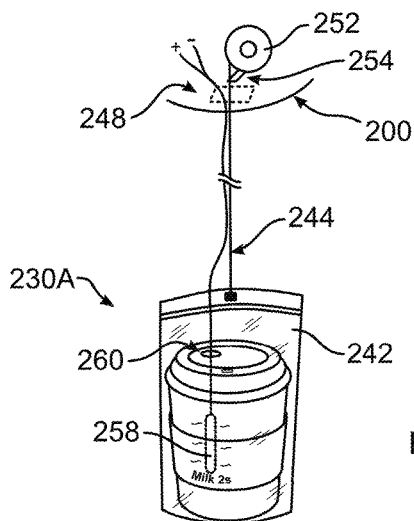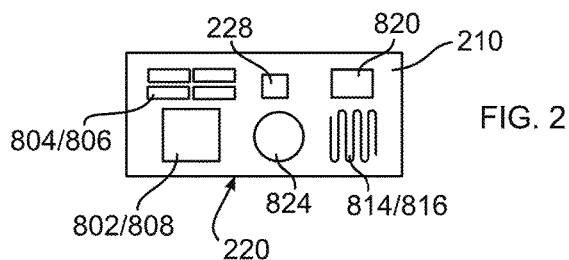Cochrane Database of Systematic Reviews, Aug. 11, 2011, pp. 1-2,
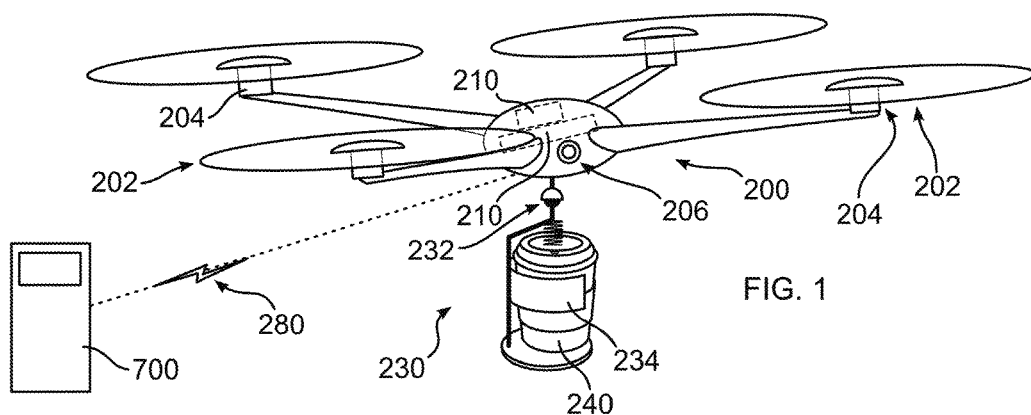Issue 1.
Watson, E., "Packaged Facts: Younger adults might be immersed in
the coffee house culture, but they don't drink as much coffee as we
think", May 6, 2014, http://www.foodnavigator-usa.com/Markets/
Packaged-Facts-2014-US-retail-foodservice-coffee-market-report,
pp. 1-4.
Drugs.com, "Caffeine Drug Interactions", http://www.drugs.com/
drug-interactions/caffeine.html%5D, last visited on Dec. 21, 2015,
pp. 1-2.
Taigman, Y., et al., "DeepFace: Closing the Gap to Human-Level
Performance in Face Verification" IEEE Conference on Computer
Vision and Pattern Recognition, Jun. 23-28, 2014, pp. 1-8.
Wikipedia, "Gesture Recognition", https://en.wikipedia.org/wiki/
Gesture_recognition, last visited on Dec. 21, 2015, pp. 1-8.
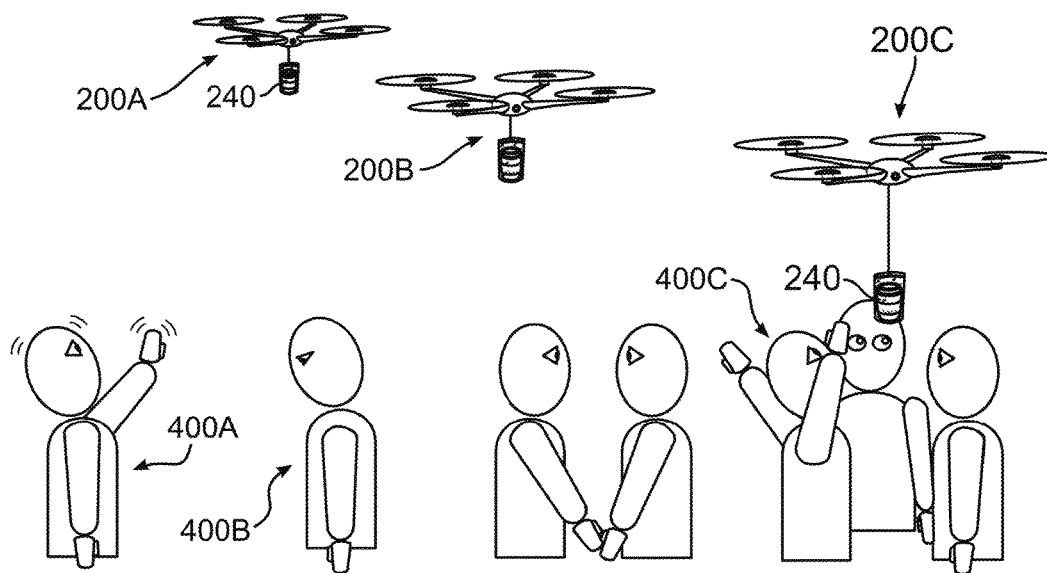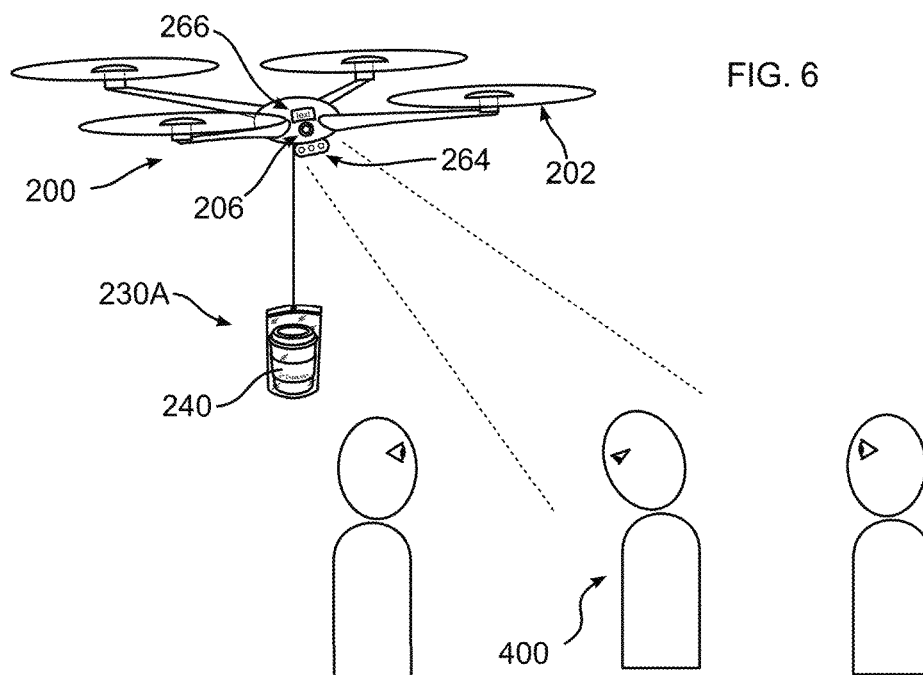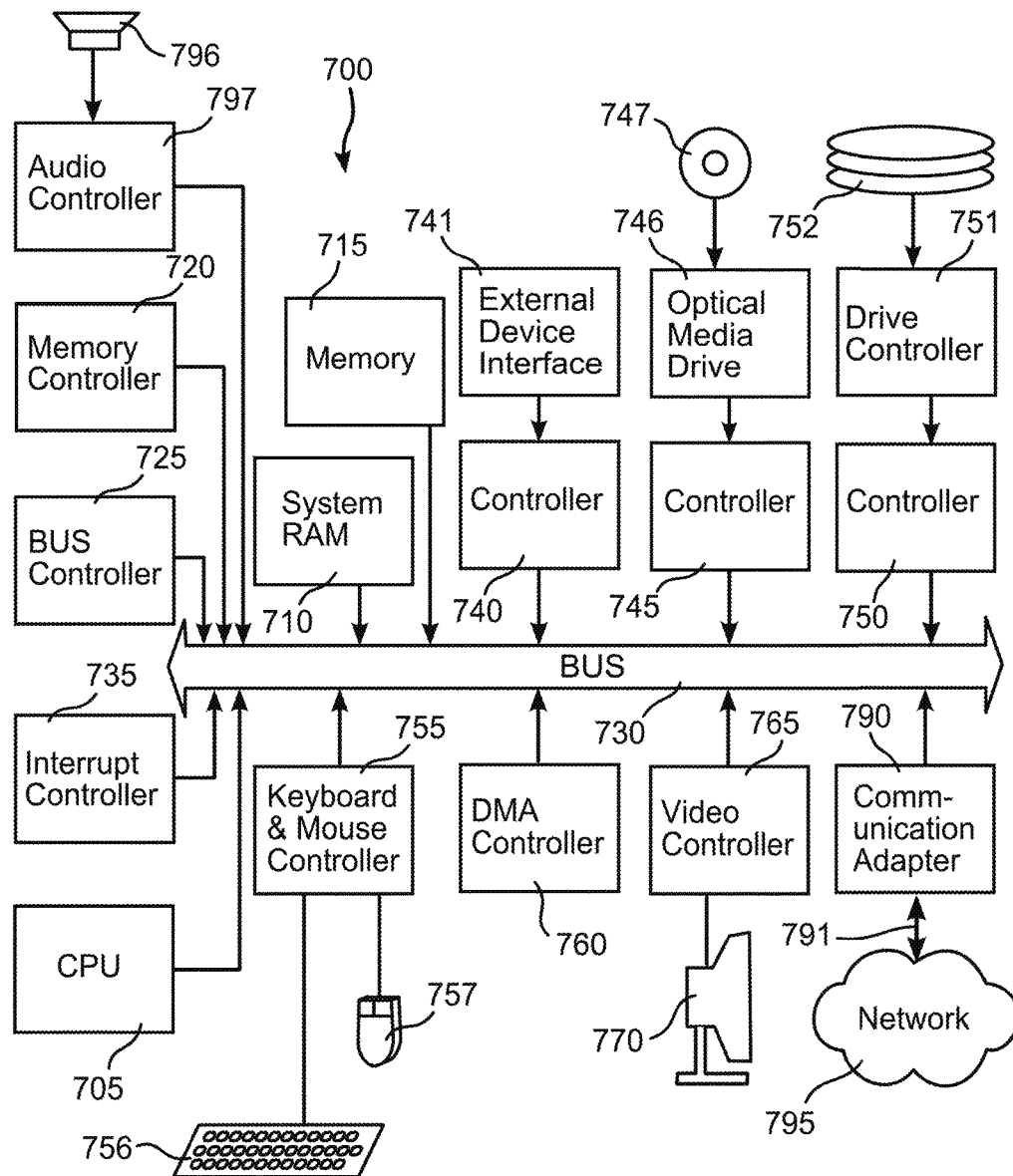

* cited by examiner

FIG. 1

FIG. 2

FIG. 3

FIG. 4

200A   240   200B   200C   400C   240   400A   400B

FIG. 5

266   200   206   264   202   230A   240   400

FIG. 6

796

797

Audio
Controller

720

Memory
Controller

725

BUS
Controller

735

Interrupt
Controller

CPU

705

756

700

715

Memory

System
RAM

710

741

External
Device
Interface

Controller

740

755

Keyboard
& Mouse
Controller

757

747

746

Optical
Media
Drive

Controller

745

DMA
Controller

760

752

751

Drive
Controller

Controller

750

765

Video
Controller

770

790

Comm-
unication
Adapter

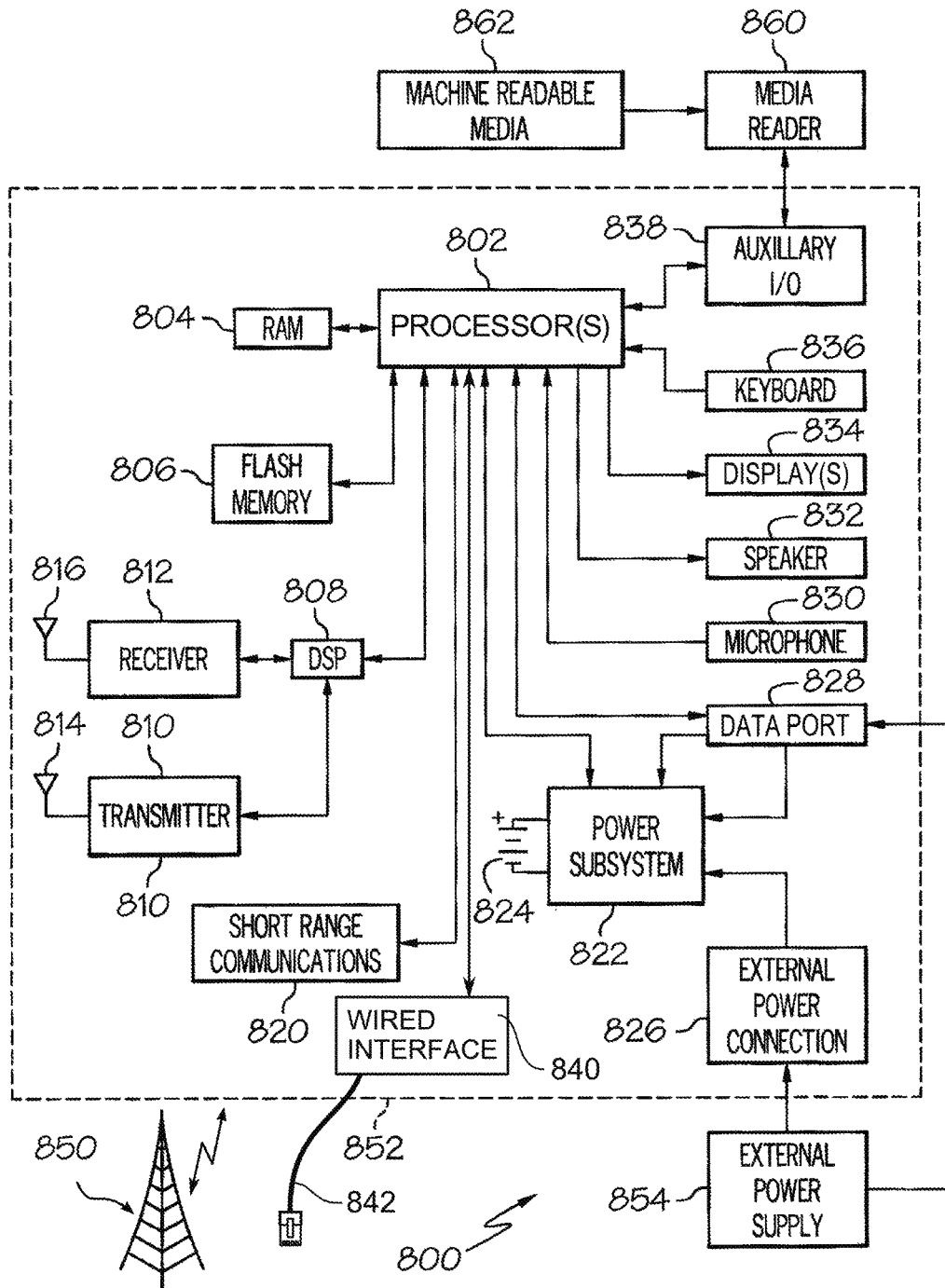791

Network

795

730

BUS

FIG. 7

FIG. 8

DRONE DELIVERY OF COFFEE BASED ON A COGNITIVE STATE OF AN INDIVIDUAL

FIELD OF THE DISCLOSURE

The disclosure relates to a system and method for using drones to deliver a drink to an individual, and more particularly, sensing a predetermined cognitive state of an individual to identify a candidate for delivery of a drink.

BACKGROUND OF THE DISCLOSURE

Quick and easy delivery of drinks is a new way of service around the world. Drone technology has increased to support delivery of packages around the world. Drone technology can also assist in customer service areas. Drones that are functioned to deliver products have yet to deliver beverages based on the person(s) being served to.

SUMMARY OF THE DISCLOSURE

In an embodiment of the disclosure, a method for delivering a drink to an individual comprises connecting the drink to an unmanned aerial vehicle (UAV); flying the UAV to an area including a plurality of people; scanning the people, using one or more sensors connected to the UAV, the one or more sensors connected to an electronic processing circuit which identifies an individual among the people that may have a predetermined cognitive state, based on sensor data; and flying the UAV to the individual that may have a predetermined cognitive state to deliver the drink to the individual.

In another embodiment of the disclosure, a method for delivering a drink to an individual comprises connecting at least one coffee drink to a fully autonomous unmanned aerial vehicle (UAV); the UAV autonomously flying to an area including a plurality of people; scanning the people, using one or more sensors connected to the UAV, the one or more sensors connected to an electronic processing circuit which identifies an individual among the people that may have a predetermined cognitive state, or that has indicated by a gesture that a drink is wanted, based upon sensor data; processing by the electronic processing circuit to determine that the individual is eligible for delivery of the drink; and the UAV autonomously flying to the individual that may have a predetermined cognitive state or who has gestured, to deliver the drink to the individual.

In a further embodiment of the disclosure, a system for delivering a drink to an individual, comprises at least one fully autonomous unmanned aerial vehicle (UAV); a drink holder connected to each of the at least one UAV; at least one sensor including at least a camera connected to the UAV; and at least one electronic processing circuit connected to obtain data from the at least one sensor, the circuit configured to use data from the sensors, including scanning images from the camera, to identify an individual that may have a predetermined cognitive state, or that has indicated by a gesture that a drink is wanted, based upon the sensor data, and to thereby cause the UAV to fly to the individual to deliver a drink to the individual from the drink holder.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present disclosure, and the attendant advantages and features thereof, will be more readily understood by reference to the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. 1 depicts, an unmanned aerial vehicle (UAV)/drone of the disclosure carrying coffee in a drink holder, the drone in communication with a server, the drone including one or more sensors;

FIG. 2 depicts a diagram of a control circuit within the drone, the control circuit including electronic circuits for flying the drone, communicating with the server, storing and accessing data, saving a processing state, and processing data;

FIG. 3 depicts a drink holder and dispensing system of the disclosure, the holder and dispenser connectable to a drone of the disclosure;

FIG. 4 depicts a variation of a drink holder and dispensing system of the disclosure, the holder and dispenser connectable to a drone of the disclosure;

FIG. 5 depicts a plurality of drones of the disclosure delivering stimulating drinks, for example coffee drinks, to individuals within a group, certain individuals indicating with gestures, or indications of a particular cognitive state, a desire for a stimulating drink;

FIG. 6 depicts a drone of the disclosure scanning an individual in group using sensors, and analyzing the sensor data and other data to determine a possibility of a particular cognitive state of the individual as a candidate for delivery of a stimulating drink;

FIG. 7 depicts a computer system having components, some or all of which can be used as part of a drone or server when carrying out the disclosure; and

FIG. 8 depicts a mobile computing system having components, some or all of which can be used as part of a drone or server when carrying out the disclosure.

DETAILED DESCRIPTION OF THE DISCLOSURE

As required, detailed embodiments are disclosed herein; however, it is to be understood that the disclosed embodiments are merely examples and that the systems and methods described below can be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present subject matter in virtually any appropriately detailed structure and function. Further, the terms and phrases used herein are not intended to be limiting, but rather, to provide an understandable description of the concepts.

The terms "a" or "an", as used herein, are defined as one or more than one. The term plurality, as used herein, is defined as two or more than two. The term another, as used herein, is defined as at least a second or more. The terms "including" and "having," as used herein, are defined as comprising (i.e., open language). The term "coupled," as used herein, is defined as "connected," although not necessarily directly, and not necessarily mechanically.

Over 80% of American adults now drink coffee, and this trend is growing, with many people drinking multiple cups of coffee per day. The present disclosure provides a method and system for assessing the cognitive state of one or more potential recipients for coffee, and delivering the coffee to them using a flying drone. More specifically, the drone can assess the cognitive state of an individual with a corresponding confidence level (L). Based on that assessment and the value of L, the drone proactively and automatically delivers coffee to one or more recipients, for example who are in a

large office complex. The assessment and estimate is based on any of: sleep quality (e.g. assessed by known methods), electronic calendar (e.g. time of day, schedule of meetings, nature of attendees at meetings, analysis of size and interaction state of a group, complexity of work schedule and topic), biometrics, blood pressure, pupil dilation, facial expression analysis, the time an individual woke up in morning, and gesture analysis. Other factors can be assessed and used in a decision to deliver coffee to an individual. In this disclosure, individuals within a group of individuals served by drones are termed 'users' of system **100**, although their participation can be entirely passive.

The drone also orchestrates the delivery of one or more coffee beverages or drinks along a route to fulfill the needs of small groups (that would wish to be served in one service), and/or to stimulate demand by providing coffee to clients who are in the view of others. The delivery may be triggered when (L>threshold) and/or the number of nearby potential recipients exceeds N. That is, if one prospective recipient turns down the offering of coffee, another nearby person may be potentially interested and offered the prepared and ready coffee. A human might also use a gesture like beaconing or waving to indicate interest, which could adjust the level of L.

Coffee consumption often has a habitual or ritualistic aspect to it, with many individuals having coffee to start their day, punctuate a mid-morning break, or as an after dinner activity. Over time, a system of the disclosure can learn times and places at which an individual tends to prefer to consume coffee, and can use that history to adjust its estimate of L for a particular person or place.

It is also the case that coffee consumption is enjoyed by people in groups. Coffee consumption can be a semi-ritualistic activity performed by a small group, and can also be an activity preferred in public, for example in a venue such as a coffee shop or salon.

In the small group context, coffee consumption can be a social practice that assists various social roles, such as easing introductions or casual conversation (ice-breaking), and for providing a change in pace (a coffee break) for an interacting group. Thus, in accordance with the disclosure, it is desirable to assess the state of the group and its interaction, including and or all of: (i) an amount of time since the group interaction began; (ii) a nature of the interaction, which can be any of a casual conversation, intense discussion, low-energy interaction, or anger or another dysfunctional interaction; and (iii) the size of the group.

With respect to item (iii), it may be preferable for one or more coffee delivery drones to deliver sufficient coffee to serve an entire group within a reasonable time period, to avoid awkwardness or discomfort associated with appearing to not serve certain group members, or by creating multiple interruptions in the group activity for coffee delivery. In an embodiment, one drone may summon another drone to fulfill an unexpectedly large demand for coffee.

The result of an analysis of items (i) to (iii) can contribute to the value of L.

If it is desired to increase consumption of coffee, and if coffee delivery and consumption is carried out in a public location where it is visible to others, social psychology suggests that the public nature of the serving and consumption will stimulate others to desire coffee in a phenomenon know as "social proof", or informational social influence. If a coffee drone has a dwindling supply of coffee, social psychology again suggests that the dwindling of the supply would increase the desirability of the coffee, and this could be leveraged by either summoning a second coffee drone to

supply the stimulated need, and/or by allowing others to bid for the remaining coffees. A coffee drone in this setting might also take advantage of social psychological effects by first providing coffee to a person who is popular, famous, or otherwise has a high social status, as social proof is known to be magnified by such factors.

Finally, both the phenomenon of social proof, and the social desirability of fulfilling the needs of an interacting group in one delivery event, suggest that a coffee delivery drone would also benefit from the ability to orchestrate deliveries with the needs of a group in mind.

Of course, potential recipients may have preference profiles. For added utility, the disclosure provides for drinks which can be milk-based drinks or filter coffees. With respect to the latter, in particular, rapid transportation is useful, as these drinks tend to develop their flavor pattern as they cool down.

A system **100** of the disclosure includes at least one unmanned aerial vehicle (UAV) or drone **200**, and an optional server **700**. At least one of the drones **200** and servers **700** have an electronic processing circuit configured to execute machine instructions to carry out the tasks described herein. Drone **200** and server **700** are configured to communicate with each other wirelessly during flight operation of drone **200**, for example using a short or long range wireless communication protocol **280**, examples including WiFi, WiMAX, BLUETOOTH, SIGFOX, 3G, 4G, LTE, or another protocol, for example using a publicly available frequency, diagrammatically illustrated in FIG. **1**. Drone **200** can have varying amounts of processing capability, but includes at least sufficient processing capacity to fly, and further includes the components normally associated with a UAV, such as a means of propulsion, for example one or more propellers **202** driven by a motor **204**, a battery **206**, one or more cameras **206**, a control circuit **210** including flight related sensors and electronics and software, and communications electronics, including wireless two way communication for remote or semi-autonomous control, although drones of the disclosure can be implemented as fully autonomous.

A four propeller drone is illustrated, although any drone configuration that can fly within an anticipated area of deployment can be used, provided it has sufficient strength to deliver coffee in the volumes required. For clarity, propeller guards are not illustrated. However, it should be understood that safety equipment should be provided, particularly as drone **200** is expected to fly near humans. Likewise, while any size drone can be used, it should not be larger than required for the intended mission as described herein, to reduce potential harm due to collision or other failure.

Control circuit **210** is diagrammatically illustrated in FIG. 2, and as mentioned, includes electronics **228** necessary to carry out flight in accordance with an intended mission, whether that is remote piloted, semi-autonomous, or fully autonomous. In an embodiment of the disclosure, drone **200** can carry out all processing tasks described herein relating to recognizing users, selecting drinks, delivering drinks, and identifying a cognitive state of humans. However, it should be understood that such tasks can be shared or divided between drone **200** and server **700** as desired, using wireless transmission of data between drone **200** and server **700**.

Other components of control circuit include non-transitory memory **224** coupled to an electronic processor circuit, such as a microprocessor **802** and/or a digital signal processor **808**, a battery to preserve a configuration state, one or more antennas **814/816**. These components, as well as

numerous other components not shown in FIG. 2, are described in more detail with respect to FIGS. 7 and 8.

The drone additional includes a coffee holder 230 which can have any of a variety of configurations. In the embodiment shown in FIG. 1, a gimbal joint 232 for enabling the coffee to remain upright as drone 200 pivots during flight, and a clamp 234 for retaining the coffee drink 240 upon the holder 230, the coffee drink 240 having the form, here, of a liquid retained within a cup having a lid. In another embodiment, the coffee can be retained within a container inside drone 200, and can be dispensed in liquid form directly from the drone. Accompaniments, such as sugar, sweetener, milk, and the like, can be dispensed in a similar manner, for example from a tube, the release of substance dispensed through the tube under control of drone 200.

In FIG. 3, an alternative coffee holder 230A is illustrated. In this embodiment, coffee drink 240 is retained within a leak proof 242 that is sufficiently strong to retain the coffee in the event the coffee is accidentally dropped from the drone before delivery. If bag 242 is transparent, it may be possible to read indicia 268 printed upon the cup of coffee drink 240 indicative of the style of coffee and the ingredients which have been added. A string 244 is connected to bag 242, the string extending to the drone to support drink 240 within bag 242 during flight and before delivery. String 244 can be connected to drone 200 in any known manner, however in the embodiment shown, a knot or wide object 246 is located at a top end of the string, and the string is passed through a slot 248 connected to drone 200 (only a portion of which is shown in FIGS. 3 and 4), the slot narrower than object 246. A movable arm 250 can be moved by a suitable mechanism, such as an electromechanical actuator (not shown) within drone 200, to push string 244 and wide object 246 out of slot 248 when the weight of drink 240 is detected to have been reduced, for example as coffee drink 240 is grasped and lifted by the recipient user, or as the bag and coffee drink are settled onto a supporting surface. The transfer of the weight of the bag and coffee drink to a supporting surface or to a hand of a user can be detected by a strain gauge or any other sensor, which can be connected to slot 248.

Alternatively arm 250 can have a cutting edge, and can cut string 244. In another variation, string 244 can be made from plastic, and arm 250 can briefly heat string 244 to weaken or cut it. In a yet further variation, slot 248 mechanically actuates to widen, thereby dropping wide object 246 and string 244 from drone 200, whereby bag 242 together with coffee drink 240 are released from drone 200 when it is detected that coffee drink 240 is supported by the recipient user or a supporting surface. In another embodiment, a mechanism within drone 200, such as a mechanical actuator (not shown), can push wide object 246 beyond slot 248 so that wide object 246, together with string 244, can drop out of connection with drone 200, releasing the payload.

Other forms of string release are possible. The length of string 244 can be selected to maintain a desired distance between drone 200 and the coffee recipient during delivery, as well as people and objects below the flight path. Alternatively, as shown in FIG. 4, string 244 can be wound on a spool 252 within drone 200, and coffee drink 240 can be lowered by unspooling string 244 while drone 200 hovers at a safe height, after which string 244 can be cut by a cutter or heating element 254 to be separated from spool 252 at the drone, or string 244 can be separated from the payload by the recipient. It may be prudent for drone 200 to have a means to release string 244 in the event it is inadvertently pulled by a user, potentially disturbing flight stability of drone 200.

While one coffee drink 240 is illustrated, it should be understood that bag 242 can safely contain any number of coffee drinks 240. In a further embodiment, drone 200 is provided with gripper fingers which can grasp a coffee cup, or bag 242, and release them at the appropriate point in time.

FIG. 4 additionally illustrates a heater 258 that can be submerged into coffee drink 240, and is electrically connected to a power source within drone 200, and can be controlled by control circuit 210. When drink 240 is about to be delivered and released, drone 200 can turn off power to heater 258 so that it cools. To conserve energy, circuit 210 can either estimate a temperature of the liquid of coffee drink 240, or can obtain a temperature reading from a sensor associated with heater 258, whereby electrical energy is provided to heater 258 only when the liquid of the drink falls below a predetermined threshold. A lid 260 can be adapted with an aperture 262 through which heater 258 can be inserted or removed. In an alternative embodiment, heater 258 can include a self-contained power source, and heater 258 can sealed within the cup and can be returned after coffee drink 240 is consumed. In a variation, heating element 258 can produce heat by an exothermic reaction, such as by the mixing of two contained chemicals which are advantageously non-toxic, released into contact with each other by bending heating element 258. This heater 258 variation may be sufficiently inexpensive to be discarded after use.

In a variation, drone 200 heating element 258 applies heat to an exterior of the coffee containing vessel, or to an exterior of bag 242, at a temperature which will not burn a human upon contact. In yet another variation, the drone includes or carries an insulating container for the liquid coffee, or the coffee cup. While a heating element can deplete energy from drone 200 quickly, the drone can be recharged automatically by landing at an automatic charging station, or can be provided with a battery replacement system which automatically replaces a depleted battery with a charged battery without human intervention.

Coffee drink 240 can be produced by any known means, whether by an automated coffee maker, a barista, or a combination of a person and a machine. Assembly of drink 240 into holder 230, or with respect to holder 230A, insertion of drink 240 into bag 242, and attachment of string 244, can all be automated using known methods of the coffee making and automation arts. An example of an automated coffee maker that can be used with system 100 is the LAVAZZA BLACK WHITE 2, although many other devices are available, with varying levels of automation. Robotic placement devices can be used to assemble prepared coffee drinks onto holder 230/230A.

It is possible in accordance with the disclosure for: all aspects of coffee production, loading of coffee onto holders, drone flight, selection of individuals having a particular cognitive state such as sleepiness, delivery to such individuals, and reloading of coffee and repeat of the foregoing steps, all without human intervention or assistance.

Coffee characteristics include the caffeine level, for example espresso, regular, or decaffeinated; the temperature; the flavor, for example the style of roasting, the origin of the beans, or an added flavoring; and the addition of sugar or sweetener, or cow, soy, or almond milk or cream. A system of the invention can produce coffee with any of the foregoing characteristics in varying strengths and quantities, and can further coordinate the production of particular styles of coffee drinks, for example espresso, cappuccino, macchiato, filter, or popular regional preparations, such as Cuban, Vietnamese or Turkish styles. Automated systems for producing various types of coffees are known, and these can be

integrated within a system **100** of the disclosure, as described herein. Alternatively, people such as baristas or chefs can prepare coffee for delivery by drones.

The disclosure provides for assessing a cognitive characteristic of potential recipients for any of: sleep cycle, bed time for the last N days, a joint measure of the characteristic for two people (e.g. husband and wife), and current blood pressure, or heart rate. The sleep cycle can be determined by accelerometers, video, and other means of motion and movement assessment. System **100** seeks individuals who have a temporarily changed or particular cognitive state, for example due to lack of quality sleep, boredom, or for any other reason. A changed cognitive state can be a cognitive state that does not match a historical cognitive state for an individual engaged in a particular activity. Cognitive states can be saved for users, for example when a user has indicated a preference for tracking, or has approved tracking, of a cognitive state. A particular cognitive state can alternatively be based upon measurements obtained from multiple people, or it can be based upon a programmed profile, and can be associated with people, generally, who are engaged in a particular activity.

System **100** can use input from a calendar, and this can include any of: meeting importance and time, nature and number of people scheduled to be at the meeting, the meeting topic, and forecasted weather, as examples.

The potential recipients can be determined, with a certain confidence, by an estimate of who is in a particular type of room, for example a kitchen or conference room, by an analysis of information from an electronic calendar.

A meeting dynamic can be estimated, which influences the coffee characteristic and coffee demand. For example, if it is known that a meeting participant is meeting with a senior supervisor, and the participant prefers coffee when under stress, the confidence level L can be increased. One or more of such cognitive characteristics can be supplied in a behavioral or preference profile of a user, and such profiles can be consulted for each meeting attendee, where the attendees are reported by the electronic calendar in an automatic system. The profile can include information for a user's physiology and responsiveness to caffeine. In an embodiment, this cognitive information is received from electronic medical records in accordance with appropriate privacy rules. Additionally, the cognitive or medical characteristics can be supplied from a user's medical history, along with prescription medication including information about currently taken medications, and the medication schedule, again according to privacy rules, and/or with the user's permission.

In another embodiment of the disclosure, multiple drones may be in flight, to help with trading of coffee, described elsewhere herein. These drones can consult user profiles of users in an area to improve a probability of having the correctly prepared coffee drinks.

In accordance with the disclosure, a sleep cycle of a user can be determined by accelerometers, video, and other means of motion and movement assessment captured during a sleeping period, as known in the art or hereinafter discovered. The disclosure uses sleep cycle information, in part, so that an assessment of possible drowsiness can be made if a user has had inadequate sleep, or has been awakened during a deep phase of sleep, which may lead to grogginess.

To determine an extent of sleep, and the quality of sleep, system **100** can capture data collected by known or hereinafter developed devices designed for this purpose. Examples include, as reported at LifeHacker.com, the FITBIT ONE device by FitBit of San Francisco, Calif.; the SLEEPASAN-

DROID or SLEEPBOT apps for Android; the JAWBONE UP device, by Jawbone of San Francisco, Calif.; or the SLEEP CYCLE app for iOS.

Prior art approaches to estimating sleep cycle typically make use of monitoring a user's movement during a sleep period. In one additional example, the SLEEP TIME ALARM CLOCK app is executed and the smartphone is placed next to a sleeper on a bed, so that an accelerometer in the smartphone can detect movement, and determine sleeping parameters. This information can be automatically or manually uploaded to system **100**, or can be entered into system **100**, where it can be used to determine a cognitive state of the user, and therefore the confidence level L can be improved.

In addition a current or forecast cognitive state of a sleeping person, for example a person in bed who may be having meeting soon, can be based on an approach published in U.S. Pat. No. 6,419,629, "Method for predicting human cognitive performance", the contents of which are incorporated by reference herein. This method can facilitate the creation of predicted cognitive performance curves that allow an individual to set their sleep times to produce higher levels of cognitive performance. The method also facilitates the reconstruction of past cognitive performance levels based on sleep history. This data can be used to improve L, as well.

A system of the disclosure can be used in an office building, workshop, or home. The current or forecasted cognitive state of the user can further be based on an assessment of other occupants in a room or bed, a real-time assessment that considers clenching of teeth, snoring, a state of a user and any medications being taken, and a multidimensional vector of cognitive states of a user and people in proximity, for example a spouse.

System **100** can be provided with, or have access to a database of medications which interact with caffeine, such as are published at http://www.drugs.com/drug-interactions/caffeine.html. Further, caffeine can act as bronchodilator and thus improve symptoms for people with asthma (see, for example, http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0010864/). Thus, when medical records indicate asthma or system **100** detects difficulty breathing, system **100** can optionally speed or prioritize a delivery of coffee to the affected user. Alternatively, caffeine may need to be avoided before certain medical tests, which can be reported to system **100**, or determined by system **100** from electronic calendar data, and the drone can therefore avoid that particular user for a proscribed period prior to the test.

Sleep deprivation impairs alertness, cognitive performance, and mood. In addition to serving coffee as described herein, other drink types including caffeine can be served including tea and soft drinks. Additionally, bar drinks containing alcohol can be served, for example at celebrations or parties, and a cognitive state can be assessed as to whether it is prudent to serve an additional bar drink. The cognitive state indicative of excess alcohol can, for certain individuals, resemble sleepiness. Other characteristics, such as unsteadiness or speech changes, can be monitored by one or more drones as described herein. However, in the case of bar drinks, system **100** can determine it is better to not serve an additional drink.

With other caffeinated drinks, and with bar drinks, all of the same cognitive characteristics as described with respect to coffee can be monitored to determine sleepiness, grogginess, drunkenness, or other health characteristic; a user profile can be consulted, which can include favorite drink types; and an electronic calendar can be consulted, and as

described elsewhere herein, these elements can be used to determine whether or not to bring a drink by drone. A quantity of caffeine, theine, alcohol, sugar, carbohydrate, calories, or any other level of stimulant, drug, or constituent in a drink is additionally factored into by system **100** as to whether or not it would be healthful, beneficial, or acceptable to deliver a particular drink to a particular user.

Further in accordance with the disclosure, information pertaining to medications currently being taken by a particular user can be compared with the type of drink requested or being offered, and a decision can be made the a particular drink should not be made available to a particular user due to a potentially unhealthful result. In this scenario, the drone can fly away from the user, ignore a summons, or display an indicator light or other indication that the drink is not available to a user. Such avoidance can additionally be carried out with respect to bringing drinks which are unsuitable or prohibited for children.

In an embodiment, system **100** recognizes faces to identify users. One or more cameras mounted in a serving area, or provided upon a drone, can gather images of users in the area. Face recognition can be carried out using any known or hereinafter developed technology, and can include for example deep learning technology, such as is described for example at http://www.cs.toronto.edu/~ranzato/publications/taigman_cvpr14.pdf. Video analytics or other software or electronic processing circuit for carrying out the face recognition can be provided within or carried entirely by the drone, or results of face recognition can be provided to the drone based on video data sent by the drone or a fixed camera to a separate and distinct processing circuit not on the drone. The face recognition can enable the drone to determine an identity of a particular user in an area, and to then bring the correct drink to the user.

With reference to FIG. **5**, in another embodiment, as with facial recognition, the drone can perform some or all of gesture recognition, either sending image data to a server which alerts the drone to particular gestures or instructs the drone to deliver to a particular user making a gesture, or the drone carriers out all such processing on-board. Such gestures can include a nod or hand wave, particularly if the user is looking at the drone. Information regarding gesture recognition can be found at https://en.wikipedia.org/wiki/Gesture_recognition. A hand wave can indicate to bring coffee, or can indicate that coffee is not wanted. System **100** advantageously can discern between a wide variety of such gestures, which can be different among people of various cultures. This is illustrated in FIG. **5**, in which user **400A** identifies that user **400B** appears to be sleepy, and gestures to drone **200B** to bring coffee. The gesture in this example includes a raised hand, and a nod of the head and/or hand, while looking in the direction of drone **200B**. In response, drone **200B** can hover near user **400A** until either user **400A** or **400B** accepts the coffee. After a predetermined interval, if the coffee is not accepted, or if a user performs a gesture interpreted as waiving away drone **200B**, drone **200B** can leave with the coffee. In an embodiment, drone **200** emits an alarm if the wrong individual intercepts the coffee or other drink.

Also in FIG. **5**, user **400C** is gesturing in a different manner to user **400A**, and is looking in the direction of drone **200C**. As with user **400A**, the head is tilted backwards, further indicating that the user is directing his attention to a drone. Accordingly, drone **200C** approaches to deliver a coffee drink **240**.

With further reference to user **400A**, system **100** can disambiguated which drone user **400A** is addressing, because drone **200A** is further away, and system **100** tracks the relative location of drones **200** operating in an area, and is thus aware of their relative locations. Eye gaze direction and body position can further be used by drones **200** to determine which drone **200** user **400A** probably expects to reply to the summoning gesture.

In another embodiment, incremental learning is used to improve the effectiveness of visual analytics components. For example, while delivering coffee to a specific person, the drone can acquire new images of users under different viewpoints and lighting, which can facilitate face recognition in future coffee deliveries.

Considering the foregoing, and referring now to FIG. **6**, it may be seen that drone **200** is using camera **206** to obtain images of users, in this case of user **400**. The image data can be wirelessly transmitted to server **700** for analysis, or can be analyzed aboard drone **200**. For simplicity and clarity, for the remainder of this discussion, processing will be described with respect to system **100** which can mean processing is carried out either by drone **200** or server **700**, however it should be understood that data analysis and computational processing can be performed in various aspects almost entirely by either server **700** or drone **200**, or any portion can be carried out by either device. In an embodiment, all drones in an area can share computational duties using parallel processing, thereby potentially eliminating a need for server **700** in high demand situations.

The image data is processed, in one embodiment, to make an initial assessment of whether user **400** seems tired, and might benefit from a caffeinated drink, such as coffee. Software executing upon a processing circuit of drone **200** or server **700** can recognize certain physical characteristics of a human that are associated with sleepiness or grogginess. In the example of FIG. **4**, it may be seen that a head of user **400** is angled downwards, indicating impending sleep, or a lack of attention to surroundings. A posture of other users in the area can be compared with a particular user, to see if the observed posture is different. However, a downwards angled head can also indicate reading or observing something at a lower position. Another indication of sleepiness is drooping or closing eyelids, also evident in FIG. **6**, particularly as compared with other users. As discussed further below, images of user **400** from a profile of user **400** can provide further indication of what user **400** normally looks like when in an attentive state, and these stored images can be compared with images currently obtained.

These initial clues to sleepiness form an initial determination of confidence level (L), but the value of L may still be too low to warrant a delivery of coffee, in accordance with a predetermined threshold. To increase L, system **100** can now attempt to learn the identify of user **400**, so that system **100** can access data corresponding to profile information of user **400**. The profile information can be cached in data storage within control circuit **220**, or a processing circuit within circuit **220** can cause transmission of a request for profile data from server **700**.

A determination of an identity of user **400** can be carried out using face recognition, as described elsewhere herein. Alternatively, all attendees at an event can be provided with an electronic tag, such as an RFID tag, which is encoded with identity information, and a corresponding tag reader connected to drone **200** can interrogate a tag of the user for the identification. In a variation, drone **200** can use a BLUETOOTH protocol to obtain identifying information from a smartphone of user **400**. In another variation, system **100** can use a speaker connected to drone **200** to audibly ask user **400** what his name is, and can use a microphone

connected to drone **200** to obtain an answer from user **400**, whereupon voice recognition can be used to identify user **400**.

Once system **100** has obtained profile data, it may determine whether user **400** is eligible for coffee, and is not excluded due to age, medical condition, medicine usage, or any other reason. If it is determined from the profile that user **400** is eligible for coffee, and it is also determined that user **400** likes coffee, and particularly likes the coffee that drone **200** is transporting, further analysis can be carried out.

For example, system **100** can examine the profile of user **400** to determine if user **400** has experienced poor sleep in the recent past. If this data is not available in the profile, system **100** can determine if sleep data is available from any other source, for example FitBit data uploaded to a location accessible to system **100**. Sleep data may also be available from an application which has collected such data on a smartphone of user **400**. Further, user **400** may have installed an application of system **100** on her phone, which has either collected sleep data, or has permission to obtain sleep data from another application, and the system **100** app can obtain this data and transmit it to system **100**, for example with a nearfield or BLUETOOTH transmission to drone **200**.

Sleep data can be analyzed in accordance with U.S. Pat. No. 6,419,629, for example, and the formula M=m(t) or $M_1=F+A_1*\cos(2Pi(t-V_1)/P_1)+A_2*\cos(2Pi(t-V_2)/P_2)$, as described therein can be used to enable the creation of predictive cognitive performance curves for a user. If the prediction is for poor performance due to sleep quality issues, L is increased. For this method, it may be necessary to first obtain data for the user relating to cognitive ability under controlled conditions, although if such data is unavailable, data from other individuals can be used to enable an estimated predictive cognitive capacity for a particular user herein.

Once sleep data has been obtained, it may be determined if user **400** has had sleep quality problems recently, and if cognitive capability is likely to be impaired, and if so, this can increase the value of L sufficiently to warrant an offer of coffee relative to other users. Other parameters can be probed as described herein, including biometric parameters. For example, drone **200** can be provided with sensors that can determine any or all of a heart rate, blood pressure, blood oxygen saturation, pupil dilation, breathing rate, skin temperature, a chemical composition of breath of user **400**, an extent of movement of user **400**, or any other physical parameters which can be analyzed for tiredness, sleepiness, or grogginess, and which can further increase a value of L, until a threshold parameter is reached for an offer of coffee. It can be advantageous to use at least two of the physiological parameters to increase an accuracy of a determination of L. Advantageously, the biometric parameters can be evaluated without contact with, or interruption to, the user. Sensors, a microphone, and a speaker are depicted as attached to drone **200** in FIG. **5**, in this example located upon a pod **264**. A display **266** is also illustrated.

Ultimately, if the value of L is otherwise satisfied, or almost satisfied, system **100** can optionally use a speaker and microphone connected to drone **200** to ask user **400** if they would like a cup of coffee. Communication with user **400**, for example for confirmation of a desire for coffee, can alternatively be carried out by a text message or voice call from system **100** to a smartphone of user **400**, which user **400** can respond to, or system **100** can display text or symbols upon a display connected to drone **200**, and user **400** can gesture or speak a response to the drone **200**.

If it is determined that coffee is to be provided to user **400**, it may be that the nearest drone does not have coffee which matches the preference of user **400**, as determined from a profile of user **400**, or based upon communication with user **400** by any of the aforedescribed means. Accordingly, a nearby drone carrying the correct style of drink can be summoned by system **100** or a gesture of user **400** to deliver a desired drink to user **400**. Alternatively, a drone **200** can return to a supply area and obtain the correct drink for user **400**.

In a further embodiment, system **100** can serve as a trans-vendor service that performs auctions of coffee offerings, which can be bundled, and which can include multiple drone deliveries. More particularly, a coffee producer can hire or license system **100** for an event or ongoing service at a particular location. Likewise, drones of system **100** can serve not only coffee or other drink as described herein, but can deliver companion products such as snacks, hors d'oeuvres, or even non-food items.

Additionally, system **100** can receive and fulfill a request for a group or series of coffee drinks. System **100** can provide a means for obtaining descriptions of available coffee drinks, their prices, and current demand, which could be based on location, cognitive state of users in a crowd, and a context of the assembly. In an embodiment, a QR code appears on the drone, or a website address, and users can scan the code or go to the website address, where they can enter a drink order, take a photo of their face so they can be recognized, or otherwise register, enter profile information, or interact with system **100**.

System **100** can include or be offered as part of an auction, or coffee/drone broker, which optimizes the distribution of selected drinks throughout a crowd. In this manner, those valuing coffee service most highly can outbid others, particularly where capacity is limited for any reason. The auction can be carried out by any known method, including for example English, Dutch, or Vickrey styles. System **100**, and the auction, can be operated within an electronic communication 'Cloud', which can be private, public, a hybrid of both, community, distributed, multicloud, or other style.

System **100** can utilize monetary or digital currency bids, but can also enable the trading of coffee drinks. This can include system **100** recognizing that two or more users do not want the style of drink served to them, and exchanging unopened and rejected drinks among such users to avoid waste. System **100** can further detect when users want to share a beverage, and can bring an extra empty cup for this purpose. Similarly, system **100** can reroute a drink at a user's request, or can deliver a drink to one user that has been ordered by another user. Alternatively, when a desired beverage is not available, system **100** can suggest a drink which is the closest available match, and deliver such a drink to a user, if indicated to be acceptable.

Example Computing System

FIG. **7** illustrates the system architecture for a computer system **700** which can be a computer server, and which can include the functions of a process controller, or other processor on which or with which the disclosure may be implemented. The exemplary computer system of FIG. **7** is for descriptive purposes only. Although the description may refer to terms commonly used in describing particular computer systems, the description and concepts equally apply to other systems, including systems having architectures dissimilar to FIG. **7**. Computer system **700** can control temperatures, motors, pumps, flow rates, power supplies, ultrasonic energy power generators, and valves, using actuators and transducers. One or more sensors, not shown, provide

US 10,040,551 B2

13

input to computer system **700**, which executes software stored on non-volatile memory, the software configured to received inputs from sensors or from human interface devices, in calculations for controlling system **200**.

Computer system **700** includes at least one central processing unit (CPU) **705**, or server, which may be implemented with a conventional microprocessor, a random access memory (RAM) **710** for temporary storage of information, and a read only memory (ROM) **715** for permanent storage of information. A memory controller **720** is provided for controlling RAM **710**.

A bus **730** interconnects the components of computer system **700**. A bus controller **725** is provided for controlling bus **730**. An interrupt controller **735** is used for receiving and processing various interrupt signals from the system components.

Mass storage may be provided by DVD ROM **747**, or flash or rotating hard disk drive **752**, for example. Data and software, including software of the disclosure, may be exchanged with computer system **700** via removable media such as diskette, CD ROM, DVD, Blu Ray, or other optical media **747** connectable to an Optical Media Drive **746** and Controller **745**. Alternatively, other media, including for example a media stick, for example a solid state USB drive, may be connected to an External Device Interface **741**, and Controller **740**. Additionally, another computing device can be connected to computer system **700** through External Device Interface **741**, for example by a USB connector, BLUETOOTH connector, Infrared, or WiFi connector, although other modes of connection are known or may be hereinafter developed. A hard disk **752** is part of a fixed disk drive **751** which is connected to bus **730** by controller **750**. It should be understood that other storage, peripheral, and computer processing means may be developed in the future, which may advantageously be used with the disclosure.

User input to computer system **700** may be provided by a number of devices. For example, a keyboard **756** and mouse **757** are connected to bus **730** by controller **755**. An audio transducer **796**, which may act as both a microphone and a speaker, is connected to bus **730** by audio controller **797**, as illustrated. It will be obvious to those reasonably skilled in the art that other input devices, such as a pen and/or tablet, Personal Digital Assistant (PDA), mobile/cellular phone and other devices, may be connected to bus **730** and an appropriate controller and software, as required. DMA controller **760** is provided for performing direct memory access to RAM **710**. A visual display is generated by video controller **765** which controls video display **770**. Computer system **700** also includes a communications adapter **790** which allows the system to be interconnected to a local area network (LAN) or a wide area network (WAN), schematically illustrated by bus **791** and network **795**.

Operation of computer system **700** is generally controlled and coordinated by operating system software, such as a Windows system, commercially available from Microsoft Corp., Redmond, Wash. The operating system controls allocation of system resources and performs tasks such as processing scheduling, memory management, networking, and I/O services, among other things. In particular, an operating system resident in system memory and running on CPU **705** coordinates the operation of the other elements of computer system **700**. The present disclosure may be implemented with any number of commercially available operating systems.

One or more applications, such as an HTML page server, or a commercially available communication application,

14

may execute under the control of the operating system, operable to convey information to a user.

Example Mobile Computing System

FIG. **8**, is a block diagram of an electronic device and associated components **800**, which can be used in carrying out the disclosure. Drone **200** can include one or all of the components of device **800**. In this example, an electronic device **852** is a wireless two-way communication device with voice and data communication capabilities. Such electronic devices communicate with a wireless voice or data network **850** using a suitable wireless communications protocol. Wireless voice communications are performed using either an analog or digital wireless communication channel. Data communications allow the electronic device **852** to communicate with other computer systems via the Internet. Examples of electronic devices that are able to incorporate the above described systems and methods include, for example, a data messaging device, a two-way pager, a cellular telephone with data messaging capabilities, a wireless Internet appliance or a data communication device that may or may not include telephony capabilities.

The illustrated electronic device **852** is an example electronic device that includes two-way wireless communications functions. Such electronic devices incorporate communication subsystem elements such as a wireless transmitter **810**, a wireless receiver **812**, and associated components such as one or more antenna elements **814** and **816**. A digital signal processor (DSP) **808** performs processing to extract data from received wireless signals and to generate signals to be transmitted. The particular design of the communication subsystem is dependent upon the communication network and associated wireless communications protocols with which the device is intended to operate.

The electronic device **852** includes a microprocessor **802** that controls the overall operation of the electronic device **852**. The microprocessor **802** interacts with the above described communications subsystem elements and also interacts with other device subsystems such as flash memory **806**, random access memory (RAM) **804**, auxiliary input/output (I/O) device **838**, data port **828**, display **834**, keyboard **836**, speaker **832**, microphone **830**, a short-range communications subsystem **820**, a power subsystem **822**, and any other device subsystems.

A battery **824** is connected to a power subsystem **822** to provide power to the circuits of the electronic device **852**. The power subsystem **822** includes power distribution circuitry for providing power to the electronic device **852** and also contains battery charging circuitry to manage recharging the battery **824**. The power subsystem **822** includes a battery monitoring circuit that is operable to provide a status of one or more battery status indicators, such as remaining capacity, temperature, voltage, electrical current consumption, and the like, to various components of the electronic device **852**.

The data port **828** of one example is a receptacle connector **104** or a connector that to which an electrical and optical data communications circuit connector **800** engages and mates, as described above. The data port **828** is able to support data communications between the electronic device **852** and other devices through various modes of data communications, such as high speed data transfers over an optical communications circuits or over electrical data communications circuits such as a USB connection incorporated into the data port **828** of some examples. Data port **828** is able to support communications with, for example, an external computer or other device.

Data communication through data port **828** enables a user to set preferences through the external device or through a software application and extends the capabilities of the device by enabling information or software exchange through direct connections between the electronic device **852** and external data sources rather than via a wireless data communication network. In addition to data communication, the data port **828** provides power to the power subsystem **822** to charge the battery **824** or to supply power to the electronic circuits, such as microprocessor **802**, of the electronic device **852**.

Operating system software used by the microprocessor **802** is stored in flash memory **806**. Further examples are able to use a battery backed-up RAM or other non-volatile storage data elements to store operating systems, other executable programs, or both. The operating system software, device application software, or parts thereof, are able to be temporarily loaded into volatile data storage such as RAM **804**. Data received via wireless communication signals or through wired communications are also able to be stored to RAM **804**.

The microprocessor **802**, in addition to its operating system functions, is able to execute software applications on the electronic device **852**. A predetermined set of applications that control basic device operations, including at least data and voice communication applications, is able to be installed on the electronic device **852** during manufacture. Examples of applications that are able to be loaded onto the device may be a personal information manager (PIM) application having the ability to organize and manage data items relating to the device user, such as, but not limited to, e-mail, calendar events, voice mails, appointments, and task items.

Further applications may also be loaded onto the electronic device **852** through, for example, the wireless network **850**, an auxiliary I/O device **838**, Data port **828**, short-range communications subsystem **820**, or any combination of these interfaces. Such applications are then able to be installed by a user in the RAM **804** or a non-volatile store for execution by the microprocessor **802**.

In a data communication mode, a received signal such as a text message or web page download is processed by the communication subsystem, including wireless receiver **812** and wireless transmitter **810**, and communicated data is provided the microprocessor **802**, which is able to further process the received data for output to the display **834**, or alternatively, to an auxiliary I/O device **838** or the Data port **828**. A user of the electronic device **852** may also compose data items, such as e-mail messages, using the keyboard **836**, which is able to include a complete alphanumeric keyboard or a telephone-type keypad, in conjunction with the display **834** and possibly an auxiliary I/O device **838**. Such composed items are then able to be transmitted over a communication network through the communication subsystem.

For voice communications, overall operation of the electronic device **852** is substantially similar, except that received signals are generally provided to a speaker **832** and signals for transmission are generally produced by a microphone **830**. Alternative voice or audio I/O subsystems, such as a voice message recording subsystem, may also be implemented on the electronic device **852**. Although voice or audio signal output is generally accomplished primarily through the speaker **832**, the display **834** may also be used to provide an indication of the identity of a calling party, the duration of a voice call, or other voice call related information, for example.

Depending on conditions or statuses of the electronic device **852**, one or more particular functions associated with

a subsystem circuit may be disabled, or an entire subsystem circuit may be disabled. For example, if the battery temperature is low, then voice functions may be disabled, but data communications, such as e-mail, may still be enabled over the communication subsystem.

A short-range communications subsystem **820** provides for data communication between the electronic device **852** and different systems or devices, which need not necessarily be similar devices. For example, the short-range communications subsystem **820** includes an infrared device and associated circuits and components or a Radio Frequency based communication module such as one supporting Bluetooth® communications, to provide for communication with similarly-enabled systems and devices, including the data file transfer communications described above. A wired interface **840** and connector **842** can be provided, configured to support any known wired communication protocol, for example USB.

A media reader **860** is able to be connected to an auxiliary I/O device **838** to allow, for example, loading computer readable program code of a computer program product into the electronic device **852** for storage into flash memory **806**. One example of a media reader **860** is an optical drive such as a CD/DVD drive, which may be used to store data to and read data from a computer readable medium or storage product such as computer readable storage media **862**. Examples of suitable computer readable storage media include optical storage media such as a CD or DVD, magnetic media, or any other suitable data storage device. Media reader **860** is alternatively able to be connected to the electronic device through the Data port **828** or computer readable program code is alternatively able to be provided to the electronic device **852** through the wireless network **850**. Sensors **870** can be provided either internal or external to a housing of device **300/800**, of any of the various types and functions as described herein.

All references cited herein are expressly incorporated by reference in their entirety. It will be appreciated by persons skilled in the art that the present disclosure is not limited to what has been particularly shown and described herein above. In addition, unless mention was made above to the contrary, it should be noted that all of the accompanying drawings are not to scale. There are many different features to the present disclosure and it is contemplated that these features may be used together or separately. Thus, the disclosure should not be limited to any particular combination of features or to a particular application of the disclosure. Further, it should be understood that variations and modifications within the spirit and scope of the disclosure might occur to those skilled in the art to which the disclosure pertains. Accordingly, all expedient modifications readily attainable by one versed in the art from the disclosure set forth herein that are within the scope and spirit of the present disclosure are to be included as further embodiments of the present disclosure.

What is claimed is:

1. A method for delivering a drink to an individual, comprising:

connecting the drink to an unmanned aerial vehicle (UAV);

flying the UAV to an area including a plurality of people;

scanning the people, using one or more sensors connected to the UAV, the one or more sensors connected to an electronic processing circuit which identifies an individual among the people that may have a predetermined sleepy cognitive state including determining a confidence level corresponding to a probable desire of

the individual for the drink including a stimulant which reduces a sleepy cognitive state, based on the sensor data and using sleep data pertaining to sleep experienced by the people when selecting the individual that may have the sleepy cognitive state;

accessing sleep data pertaining to a sleep cycle of the individual determined by motion detection of the individual during a sleep period, and adjusting the confidence level in accordance to the sleep data; and

if the confidence level reaches a predetermined level, flying the UAV to the individual that may have the sleepy cognitive state to deliver the drink including the stimulant to the individual.

2. The method of claim **1**, wherein the UAV is fully autonomous, and flies to the area and flies to the individual without human assistance.

3. The method of claim **1**, wherein the electronic processing circuit is on the UAV.

4. The method of claim **1**, wherein the electronic processing circuit is not on the UAV, and the UAV transmits sensor data wirelessly to the electronic processing circuit to identify the individual.

5. The method of claim **1**, where the drink includes coffee.

6. The method of claim **1**, wherein the electronic processor circuit determines an individual that may have a predetermined cognitive state by examining a physiological state of the individual determinable using the sensor data.

7. The method of claim **1**, wherein scanning the people includes obtaining images of the people, the images being analyzed to determine an angular disposition of at least one of the head, eyes, back, and shoulders of one or more of the people.

8. The method of claim **6**, wherein the sensor data includes one or more of heart rate, blood pressure, pupil

dilation, breathing rate, skin temperature, and a chemical composition of breath, of at least one of the people.

9. The method of claim **6**, wherein the sensor data includes one or more of biometrics, blood pressure, and facial expression analysis.

10. The method of claim **1**, wherein the electronic processor circuit uses sensor data to determine an identity of one or more of the people.

11. The method of claim **1**, wherein the electronic processor circuit uses image data of one or more of the people to determine an identity of an individual using a face recognition algorithm.

12. The method of claim **1**, wherein the electronic processing circuit accesses electronic calendar data relating to one or more of the people, and determines a likelihood that an individual among the people may have a predetermined cognitive state using meeting schedules of individuals among the people.

13. The method of claim **1**, wherein if the individual identified rejects the delivered drink, the UAV selects another individual for delivery of the drink.

14. The method of claim **1**, wherein a plurality of the people have provided informational profiles including data relating to a sleep state.

15. The method of claim **1**, wherein the sensor data is analyzed by the electronic processor circuit to identify a gesture of at least one of the people indicating a desire for the drink.

16. The method of claim **1**, wherein delivering the drink to the individual includes lowering the drink to the individual on a string.

17. The method of claim **1**, wherein the motion detection is carried out using at least one of an accelerometer and camera.

* * * * *